A NOTE ON THE OCCURRENCE OF OESOPHAGEAL TEETH IN SPECIES OF THE GENUS *CLOACINA* (NEMATODA : STRONGYLOIDEA)

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SUMMARY

It has been found that in some species of *Cloacina* teeth project from the lining of the oesophagus into the lumen. Each tooth lies in the mid-line of a sector of the oesophagus. In each species the number, arrangement and position of the teeth is constant. There is no evidence that they serve as outlets for oesophageal glands.

INTRODUCTION AND METHODS

In a recent study of the nematodes from the Western Australian wallaby, *Setonix brachyurus*, a new species, *Cloacina setonicis*, was identified and described (Mawson, 1961). In this species teeth were noted projecting into the lumen of the oesophagus near its anterior end. Such teeth do not appear to have been described from other Trichoneminae, nor, indeed, from any other nematode, other than at the anterior end projecting into the buccal cavity. The question arises, are they present, but unobserved, in other species of the same genus? Preliminary investigations into this possibility have shown that teeth are present in some species, not in others. Examination has been made of the paratypes of some *Cloacina* spp. and of some freshly obtained *Cloacina* spp., as well as of some species of related genera.

If teeth be present they can be seen in an entire mount of a fresh specimen cleared in lactophenol. In specimens which have been preserved for a long time and are dark, it is necessary to clear with gum chloral or Berlese's fluid (both of which are excellent media for showing cuticular structures) and sometimes to make a separate mount of the oesophagus. In any case, this last was done wherever possible, as the teeth may be seen much more distinctly. To find the relation of the teeth to the wall and lumen of the oesophagus, sections were made, mostly transverse sections in series. Some were made from paraffin embedded specimens using a microtome, others with a fine knife under the dissecting microscope. These latter had the advantage that it was possible to make the cut at the angle and in the position desired, which, with curved worms, is almost impossible with the microtome. The hand-cut sections were made about 30-40μ thick, and were mounted in Berlese's fluid. Though some of the material was stained with Delafield's haematoxylin no attempt has been made at any real study of the histology. The oesophagus of some of the freshly obtained specimens was left for about 12 hours in 10 p.c. potassium hydroxide solution, so that all but the chitinous lining was destroyed, leaving the teeth (if present) very clearly visible.

DESCRIPTION OF TEETH

In many *Cloacina* species, if not in all, the lining of the oesophagus appears in whole mounts to be uneven. In section this is seen to be due to the undulating nature of the radial arms of the lumen, rather than to any particular thick-

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ening of the lining. This uneven appearance is seen also in other strongyles; it has been described, for example, by Immink (1924) for *Strongylus edentatus*. In the Australian genera *Zoniolaimus* and *Pharyngostrongylus* the lining usually does not give this appearance. The structures which are now identified as teeth in *Cloacina* spp. are very much more definite than these projections and cannot possibly be mistaken for them. The teeth occur only in some species and in these they are arranged in a characteristic way and in a constant position in the oesophagus. Even in the few species so far examined it is clear that the presence and arrangement of the teeth are a feature of value in identification of the species.

The structure of the oesophagus of *Cloacina* spp. is very similar to that of other strongyles in which it has been described, but there are differences in the position and number of the longitudinal thickenings on the lining of each section. Typically, in the anterior part the lumen is wide with pinched angles, and the lining of more or less even thickness. Further back the lumen is relatively smaller and more tri-radiate, and the lining develops the longitudinal rods or thickenings, apparently formed by fusion of a rod from each of adjacent sectors. The longitudinal canal seen in some nematodes at the outer end of each radius of the lumen has not been seen in any of the *Cloacina* spp. examined.

In species in which a tooth is present, the tooth projects into an enlargement of the lumen which is sometimes reflected in a slight swelling of the whole oesophagus. The tooth is the shape of a rose thorn, projecting either forward, or, more rarely, backward, into the lumen. Each tooth is formed in the midline of the sector involved from the greatly thickened cuticular lining, the projecting point balanced in case of large teeth by an extension of the thickening into the oesophageal tissue.

It is not clear whether the tooth is of functional importance. There does not appear to be any outlet through it for glandular secretion, certainly no duct has been found similar to that in *Ancylostoma* spp. There is no evidence that the teeth are movable; they are always at the same angle in different specimens of a species. They might help in some way to regulate the flow of oesophageal contents, but their appearance does not suggest that they would form efficient valves. If their action is merely abrasive, the presence of a point is unexplained.

From the few species so far studied, it appears that teeth may occur in one of three regions of the oesophagus, and that in each region the character of the tooth is slightly different.

1. At the anterior end, close to the mouth, e.g. *C. setonicis*. In this species the teeth are small.
2. Just in front of the nerve ring, e.g. *C. magnipapillata*, *C. macropodis*, *C. longispiculata*. In these the teeth are of medium to large size and the roots not pronounced; the oesophagus is swollen in the region of the teeth.
3. Well behind the nerve ring, just in front of the terminal oesophageal swelling, e.g. *C. communis*, *C.* sp. inq. In these the teeth are larger, more numerous, and with well developed basal processes; the oesophagus is swollen in the region of the teeth.

SPECIES IN WHICH TEETH ARE NOT PRESENT

Both fresh material and paratype specimens have been examined of *C. hydriformis* Johnston and Mawson 1938, and *C. parva* Johnston and Mawson 1939, and no teeth have been observed. They appear to be absent also in the paratype specimens of *C. bancroftorum* Johnston and Mawson 1939, and *C. thetidis* Johnston and Mawson 1939, and although these are long-preserved

specimens, they are in such good condition that it is thought that, if present, they would be seen. Some other species which have been examined but in which teeth are apparently absent, are *Pharyngostrongylus alpha* J. and M. 1938,

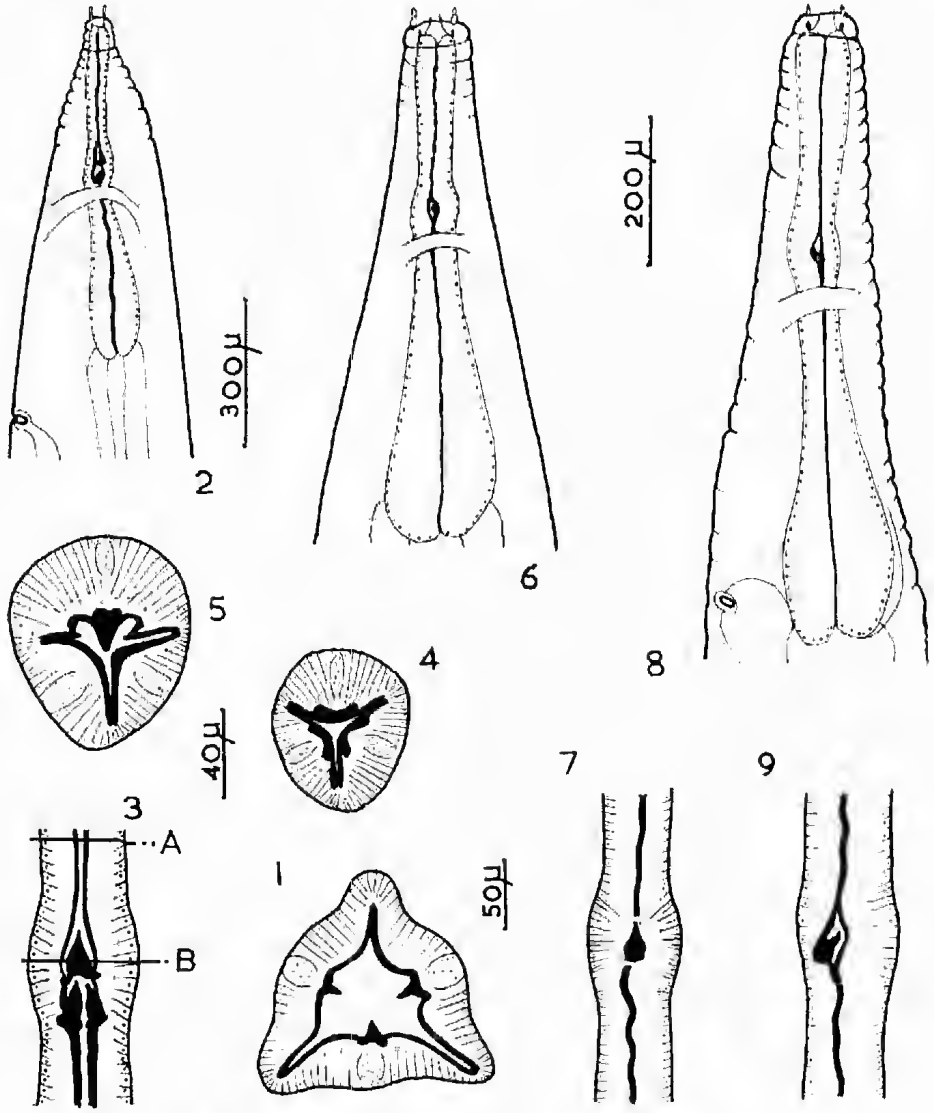


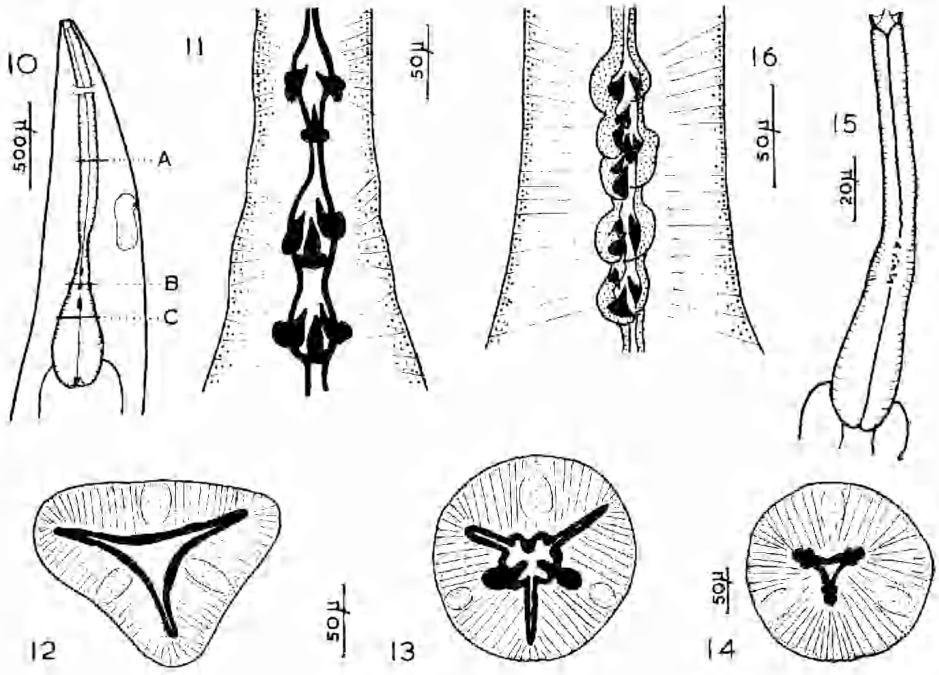
Fig. 1. *Cloacina setonicis*, T.S. of oesophagus near anterior end. Figs. 2-5. *C. magnipapillata*. 2, anterior end of body; 3, oesophagus in region of prenenral bulge; 4 and 5, sections of oesophagus at levels indicated on Fig. 3 by lines A and B respectively. Figs. 6-7. *C. longispiculata*. 6, anterior end of body; 7, oesophagus in region of preneural bulge. Figs. 8-9. *C. macropodis*. 8, anterior end of body; 9, oesophagus in region of preneural bulge. Figs. 3, 4 and 5 to same scale; Figs. 1, 7 and 9 to same scale.

P. beta J. and M. 1938, *Labiostrongylus longispiculata* Wood 1929, *L. eugenii* J. and M. 1940, and *Trichonema* spp. from a local horse, all of which were studied as fresh material, and *Quilonia* sp., long preserved, from a zoo elephant.

SPECIES IN WHICH TEETH HAVE BEEN FOUND

Cloacina setonicis Mawson (1961, 81) (Fig. 1)

Type material was examined when newly preserved. Six small, backwardly directed teeth are present, arranged in two circles each of three teeth, the most anterior just behind the buccal capsule, the second a short distance behind this. Profile views of teeth in the oesophagus are given in Figs. 1 and 2 of the original description.



Figs. 10-14. *Cloacina communis*. 10, anterior end; 11, pre-bulbar region of oesophagus; 12, 13 and 14, transverse sections through oesophagus at levels shown on Fig. 10 by lines at A, B and C respectively. Figs. 12 and 13 to same scale. Figs. 15-16, *Cloacina* sp. inq. 15, oesophagus; 16, prebulbar region of oesophagus.

Cloacina magnipapillata Johnston and Mawson (1939, 530) (Figs. 2-5)

Fresh material belonging to this species has now been obtained from *Macropus robustus* from Western Australia. About thirty worms have been examined and teeth are clearly present in all, in exactly similar position and arrangement in all specimens. They lie in a slight swelling of the oesophagus just in front of the nerve ring. There are three teeth, the larger of which comes from the dorsal sector of the oesophagus and lies just in front of the other two, which are subventral.

Paratype specimens of this species have also been examined. They are very dark with age. Teeth are not distinct, but there is a suggestive swelling of the outline of the oesophagus in front of the nerve ring, and an interruption of the central line of the oesophagus in this region.

Cloacina longispiculata Johnston and Mawson (1939, 131) (Figs. 6-7)

Paratype material has been examined, but no fresh material is available. When cleared in Berlese's fluid, there appears to be a single small tooth lying just anterior to the nerve ring in a slight swelling of the oesophagus.

Cloacina macropodis Johnston and Mawson (1939, 278) (Figs. 8-9)

No fresh material is available of this species. In paratype specimens a tooth is clearly present, lying just anterior to the nerve ring. The appearance of the oesophagus in this species is very similar to that of *C. longispiculata*, but the species may be distinguished by the shape and size of the sub-median cephalic papillae, and by the very long spicules in *C. longispiculata*.

Cloacina communis Johnston and Mawson (1938, 275) (Figs. 10-14)

Fresh and paratype specimens have been examined and teeth are distinct in cleared specimens. There are three successive groups of three teeth each, the hindermost group lying where the oesophagus widens towards the terminal bulb; at the level of each group the oesophagus is slightly wider. The teeth are large with well-developed basal thickenings.

Cloacina sp. inq. (Figs. 15-16)

Some worms belonging to a species resembling *C. frequens* and *C. ernabella* have been found in *Macropus robustus* from Marble Bar in Western Australia. As only females are present, the species cannot be identified. The dentition in these is, however, so distinctive that a figure has been included here. There are about fifteen teeth lying where the oesophagus begins to widen posteriorly. They are arranged in roughly five groups closely succeeding one another. The teeth are mostly large with well-developed basal structures, and point forward, but at least two are small.

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